GPC Light Shaper for Contemporary Neurophotonics.

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GPC Light Shaper for Contemporary Neurophotonics

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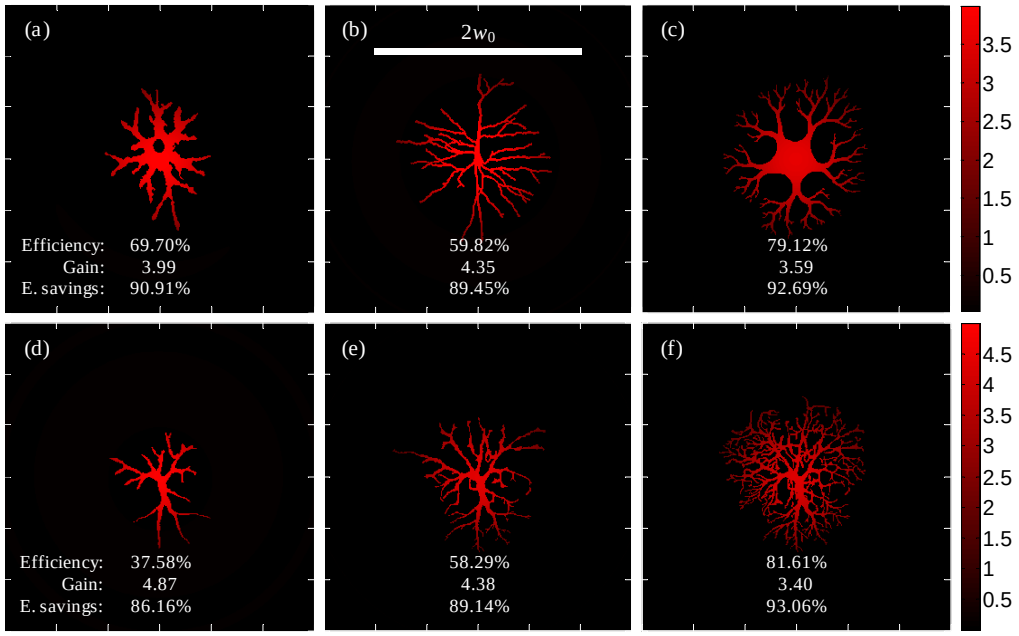
Generalized Phase Contrast (GPC) is an efficient method for generating *speckle-free* contiguous optical distributions useful in diverse applications such as static beam shaping, optical manipulation and recently for excitation in two-photon optogenetics. To fully utilize typical Gaussian lasers in such applications, we analytically derive conditions for photon efficient light shaping with GPC. When combined with the conditions for optimal contrast developed in our previous works, our analysis further simplifies GPC's implementation. The results of our analysis are applied to practical illumination shapes, such as a circle and different rectangles commonly used in industrial or commercial applications. We also show simple and efficient beam shaping of arbitrary shapes geared towards biophotonics research and other contemporary applications. Assessment of the energy savings when comparing to conventional amplitude masking show that up to ~93% of typical energy losses are saved.



[1] J. Glückstad and D. Palima, "Generalized Phase Contrast: Applications in Optics and Photonics", Springer Series in Optical Sciences, 310 pp (2009).

[2] A. Bañas, D. Palima, M. Villangca, T. Aabo, and J. Glückstad, "GPC Light Shaper for speckle-free one and two- photon contiguous pattern excitation," to appear in Optics Express (2014).

[3] S. Tauro, A. Bañas, D. Palima, and J. Glückstad, "Experimental demonstration of Generalized Phase Contrast based Gaussian beam-shaper," Optics Express **19**, 7106–7111 (2011).

[4] D. Palima and J. Glückstad, "Gaussian to uniform intensity shaper based on generalized phase contrast," Optics Express **16**, 1507–1516 (2008).

[5] D. Palima, C. A. Alonzo, P. J. Rodrigo, and J. Glückstad, "Generalized phase contrast matched to Gaussian illumination," Opt. Express **15**, 11971–11977 (2007).

[6] E. Papagiakoumou, F. Anselmi, A. Bègue, V. de Sars, J. Glückstad, E. Y. Isacoff, and V. Emiliani, "Scanless two-photon excitation of channelrhodopsin-2," Nat. Methods **7**, 848–854 (2010).

Brief biography

Prof. Jesper Glückstad established the Programmable Phase Optics www.ppo.dk in Denmark more than a decade ago and currently holds a position as Professor at DTU Fotonik, Dept. of Photonics Engineeering at the Technical Univ. of Denmark, and a position as Guest Professor in Biophotonics at Lund Institute of Technology, Sweden. In 2004 he received the prestigious Doctor of Science (DSc) degree from the Technical University of Denmark for the dissertation entitled "The Generalised Phase Contrast method". Together with a colleague he has authored a Springer book on this topic published in the fall 2009. Prior to his achievements in Denmark, Prof. Glückstad was a visiting scientist at Hamamatsu Photonics Central Research Laboratories and in the Physics Dept. at Osaka University in Japan. Since he obtained his PhD at the Niels Bohr Institute in 1994, he has published more than 250 journal articles and international conference papers and holds more than 25 international patents and patent applications. He has published papers in *Nature Materials, Nature Methods and Nature Photonics*. He is the year 2000 recipient of the Danish Optical Society Award and was elected as «Scientist of the Year» in 2005 by the Ib Henriksens Foundation in Denmark. Prof. Glückstad is a 2010 elected Fellow of the OSA and a Fellow of the SPIE as the only from Denmark. In 2012-2014 he is appointed for the prestigious SPIE Fellows committee. In 2013 he will be joining the Editorial Board of JEOS. Most recently he founded the DTU start-up OptoRobotix originally spun out in Silicon Valley, CA, i.e. www.optorobotix.com